PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
DAK/P10038WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB 03/03015	11.07.2003	13.07.2002
International Patent Classification (IPC) or both national classification and IPC		
F02D41/40		
Applicant		
DELPHI TECHNOLOGIES, INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

EPO - DG 1

10. 12. 2004

(52)

3. This report contains indications relating to the following items:

   I ☒ Basis of the opinion
   II ☐ Priority
   III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   IV ☐ Lack of unity of invention
   V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   VI ☐ Certain documents cited
   VII ☐ Certain defects in the international application
   VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
28.01.2004	25.10.2004
Name and mailing address of the international preliminary examining authority:	Authorized Officer
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB 03/03015

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1, 2, 4, 5, 7-18	as originally filed
3, 6	received on 15.07.2004 with letter of 13.07.2004

Claims, Numbers

2-8, 10-12	as originally filed
1, 9	received on 15.07.2004 with letter of 13.07.2004

Drawings, Sheets

1/7-7/7	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

see separate sheet

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item I, point 6

Amended page 6 seems to be lacking lines 24 and 25 from the original one ("*timing between ... 1700 bar.*")

Re Item V

1 INDEPENDENT CLAIM 1

Document **EP 1 065 368 A2** (DELPHI TECH INC) is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (the references in parentheses applying to this document) a control method for a fuel injection system having a spill valve (41), a nozzle control valve (24) and a valve needle (12) which is engageable with a seating to control fuel injection, the method comprising:
applying a first drive current signal to the spill valve (41) to move the spill valve (41) into a closed state and applying a second drive current signal to the nozzle control valve (24) to move the nozzle control valve (24) to an open state (paragraphs [0022] and [0023]), thereby to lift the valve needle (12) from the seating to initiate a main injection of fuel, and
modifying (see col. 5, lines 36-43) the first drive current signal applied to the spill valve (41) so as to move the spill valve (41) from the closed state to an open state during a spill valve opening period and modifying the second drive current signal applied to the nozzle control valve (24) to move the nozzle control valve (24) from the open state to a closed state just before or "at about the same time as" the spill valve (41) is opened (i.e. just before or at the same time as the time at which the first drive current is applied), so as to urge the valve needle (12) towards its seating to terminate the main injection of fuel.

The subject-matter of claim 1 differs from **EP 1 065 368 A2** in that to terminate the main fuel injection, the first drive current signal is applied to move the spill valve followed by applying the second drive current to move the nozzle control valve during the spill valve opening period.

The problem to be solved by the present invention may be regarded as reducing noise when closing the injector, i.e. the rate of pressure decay when opening the spill valve is reduced by a pressure wave generated by the closing of the injector valve at the same time.

None of the cited documents discloses such a timing for closing the spill and nozzle control valves.

Claim 1 is therefore new (Article 33(2) PCT) and inventive (Article 33(3) PCT).

2 INDEPENDENT CLAIM 9

The method of claim 9 applies a similar concept to the post injection of fuel and meets therefore the requirements of the PCT with respect to novelty and inventive step following the above arguments.

3 Claims 2 to 8 and 10 to 12 are dependent on claims 1 or 9 and as such also meet the requirements of the PCT with respect to novelty and inventive step.